# OPTICALLY CLEAR FILLED SILICONE ELASTOMERS

This application is a continuation-in-part of my co-pending application, Ser. No. 572,788 filed Apr. 29, 1975.

## FIELD OF THE INVENTION

This invention relates to optically clear, reinforced, inter-polymers of aryl and alkyl siloxanes, forming silicone elastomeric, soft plastic contact lenses. More particularly, this invention relates to silica filled vulcanizates of two or more copolymers of dimethyl siloxane with at least one of diphenyl siloxane or methylphenyl siloxane.

## BACKGROUND OF THE INVENTION

Many silicone elastomers, when unfilled, generally have excellent optical clarity and are usually water-white in color. The tensile strength, and especially the tear strength, of such elastomers is poor, however. By filling the elastomers with fine particulate solids, the silicone resin or gum stock will produce, when vulcanized and cured, an elastomer with much improved strength. Fillers used with silicone elastomers have been the usual fillers for plastics, but the fillers are limited when optical clarity of the elastomer is essential. Commonly used dimethyl siloxane, with a vulcanizing agent, produces a silicone elastomer, but for satisfactory use it needs a filler for strength. One filler used for silicone elastomers is finely divided silica, known as smoke or fume silica. This filler when added to dimethyl siloxane elastomer, or gum stock and then vulcanized, produces a translucent elastomer, generally considered useless for objects needing optical clarity, such as lenses. This is primarily due to the mismatch of the indices of refraction of fume silica and dimethyl siloxane.

In U.S. Pat. No. 3,341,490 there is described a blend of vinyl-type siloxane units which may be filled with a silica filler forming, after vulcanizing and curing, products which are useful in the manufacture of articles having optical clarity.

## THE INVENTION

The present invention provides, in one form, for making copolymers of diphenyl siloxane and dimethyl siloxane, in about a ratio of 12 mole percent of phenyl to methyl groups in the copolymer. This invention includes a reinforced silicone-type, soft plastic contact lens containing about 6% to about 16% mole of aryl groups comprising a copolymer of:

a. an aryl siloxane,
b. an alkyl siloxane, and
c. a silica filler,

said lens being characterized by the silicone copolymer having essentially the same refractive index as the silica filler, forming a transparent, optically clear lens. Minor variations in the compositions will have only a slight effect upon optical clarity. Since mixtures of highly arylated silicone oils or gums are generally not miscible with the alkyl siloxanes, copolymers must be used. Mixtures of two or more silicones containing nearly the same aryl-alkyl (typically phenyl-methyl) ratio can be mixed to obtain the precise refractive indices to match the silica filler. The optical dispersions will not normally match perfectly, but the matches can be made sufficiently close to avoid significant interference with optical clarity of the lenses.



## OBJECTS OF THE INVENTION

One of the objects of the present invention is to produce a silicone elastomer of aryl siloxane and alkyl siloxane containing an aryl-alkyl group ratio providing a refractive index which substantially matches the index of refraction of a filler to be used with the elastomer.

Another object of the invention is to provide copolymers of diphenyl siloxane and dimethyl siloxane containing about twelve mole percent diphenyl groups to the methyl groups having a refractive index substantially matching that of a fume silica filler.

Another object of the invention is to provide optically clear silica-filled silicone elastomers formed of aryl and alkyl siloxanes.

Still another object of the present invention is to provide a silica-filled contact lens having an elastomer of two polymers, one having terminal vinyl groups and the other having terminal $(R)_2HSi—O—$ groups, where R is methyl or ethyl. In other respects the polymers are similar with the noted terminal groups being present only in their respective polymer.

These and other objects of the invention may be ascertained by referring to the following description and appended claims which set forth the general invention.

## SPECIFIC INVENTION

Generally, a copolymer of an aryl siloxane and an alkyl siloxane containing about 12 mole percent of the aryl groups will have a refractive index which will substantially match that of a fume silica filler, making the elastomeric product transparent or substantially transparent. In one specific case, a copolymer of diphenyl siloxane and dimethyl siloxane containing about 12 mole percent of the diphenyl groups with a balance of dimethyl groups produces a product which will be essentially transparent with a fume silica filler. Also, a copolymer of phenyl-methyl siloxane (about 24 mole percent) with dimethyl siloxane produces a copolymer (containing about the same proportion of phenyl and methyl groups) product having a refractive index which will match that of the fume silica filler. Other co- or ter-polymers, containing the same proportion of phenyl and methyl groups will produce products which are transparent with the fume silica fillers. Minor variations in the composition of the polymers have a slight effect upon optical clarity.

Preferably, the contact lens of this invention includes:

A. A polymer of
   1. dimethyl siloxane,
   2. diphenyl siloxane or phenyl-methyl siloxane or both, and
   3. vinyl siloxane,

   which contains a small amount of a platinum catalyst in solution;
B. A polymer of
   1. dimethyl siloxane,
   2. diphenyl siloxane or phenyl-methyl siloxane or both, and
   3. a siloxane having $(R)_2HSi—O—$ groups, or $—O—SiHR—O—$ groups or both, wherein R is methyl or ethyl, and preferably methyl; and

C. 5 to 20% fume silica.